International Standard 4116

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Ground equipment requirements for compatibility with aircraft unit load devices

Caractéristiques de l'équipement au sol en vue d'assurer sa compatibilité avec les unités de charge d'aéronefs

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4116 was developed by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, and was circulated to the member bodies in November 1977.

It has been approved by the member bodies of the following countries :

Australia	India	Romania
Austria	Ireland	South Africa, Rep. of
Belgium	Israel	Spain
Brazil	Italy	Turkey
Canada	Japan	USA
Chile	Mexico	USSR
France	Netherlands	Yugoslavia
Germany, F.R.	Poland	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Czechoslovakia
United Kingdom

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Ground equipment requirements for compatibility with aircraft unit load devices

0 Introduction

The term device used in this International Standard is intended to mean aircraft unit load device.

It is intended that this International Standard should apply to equipment manufactured or installed after publication of this International Standard.

a) These requirements reflect current criteria applied to known successfully operated hardware. Any design deviations shall be required to demonstrate equivalency to the criteria specified in this International Standard.

b) These devices usually form an integral part of the aircraft and as such are subject to the requirements of regulatory agencies, to assure structural integrity.

1 Scope and field of application

This International Standard specifies requirements for those portions of the aircraft unit load device ground and terminal handling equipment that will have a direct bearing on the life of the device for the purpose of preventing undue wear on the device. (Experience has shown that inadequate design and maintenance of ground equipment increase the cost of unit load devices.)

Included in this International Standard are requirements for conveyor systems, guides, stops and restraint hardware that are used on trucks, transporters, dollies, storage provisions, pallet build-up hoists, or other device-handling equipment.

The devices (aircraft unit load devices) referred to in this International Standard can be containers, galley modules and pallets for aircraft galley and cargo systems. Size, shape and load capacities of devices are not included herein.[1]

2 Equipment requirements

2.1 Conveyor systems for transport of devices

2.1.1 Uni-directional conveyor system (rollers)

Characteristic	Requirement
a) Roller diameter	50 mm (2 in) min.

1) Specification details for these features can be obtained from other International Standards or from International Air Transport Association (IATA) specifications, the airline operator and the device manufacturer.

b) Roller length	100 mm (4 in) min. effective bearing length

The cumulative length of any number of rollers on a common axis shall support at least 50 % of the corresponding device dimension. A staggered pattern of rollers shall provide equivalent support.

Characteristic	Requirement
c) Lateral spacing between roller ends	406 mm (16 in) max.
d) Distance between centreline rollers less than 100 mm (4 in) in diameter	250 mm (10 in) max.
e) Distance between centrelines of 100 mm (4 in) diameter and larger	305 mm (12 in) max.
f) Radius at roller edges	3 mm (0.125 in) min.
g) Allowable overhang (distance between roller edge and guide)	152 mm (6 in) max.

h) The allowable height difference for rollers shall be a maximum of 3,2 mm (0.125 in) in any 1,52 m × 1,52 m (5 ft × 5 ft) area and 0,8 mm (0.032 in) between any two adjacent rollers. The support structure stiffness and tolerance shall be designed to meet the above requirement when supporting an empty device or one loaded to its maximum payload capacity.

2.1.2 Multi-directional conveyor (for transient traversing conditions only).

Characteristic	Requirement
a) Allowable spacing for castored rollers throughout the area traversed by the device	250 mm (10 in) max. in two directions 90° apart
b) Castored roller diameter	76 mm (3 in) min.
c) Castored roller width	25 mm (1 in) min.
Edge radius 3,2 mm (0.125 in) min.	19 mm (0.75 in) contact area
d) Allowable spacing for ball transfers throughout the area traversed by the device, except for those areas where supported by other means	127 mm (5 in) max. in two directions 90° apart
e) Diameter of balls	25 mm (1 in) min.

f) Balls : Any ball support shall utilize spring-loaded balls with a suggested pre-load close to 310 N (70 lbf) and not exceeding 450 N (100 lbf). The ball load at maximum displacement shall not exceed 665 N (150 lbf).

g) The allowable height difference for castored rollers or unloaded ball transfers shall be a maximum of 3,2 mm (0.125 in)in any 1,52 m × 1,52 m (5 ft × 5 ft) area, and 0,8 mm (0.032 in) between any two adjacent castored rollers or ball transfers. The support structure stiffness and tolerance shall be designed to meet the above requirement when supporting an empty device or one loaded to its maximum payload capacity.

2.2 Flat top systems

Conveying or storage systems that provide flat area contact supporting means (such as flat top chain traverse systems, frame rack storage areas, or road vehicles).

Characteristic	Requirement
a) Percentage of contact area supporting base of device, not otherwise supported	20 % min.
b) Allowable overhang (unsupported, such as by rollers)	311 mm (12.25 in) max.
c) Allowable spacing between support surfaces lateral to movement, not otherwise supported	406 mm (16 in) max.
d) If spacing exists between supports in direction of movement, this allowable spacing shall be	305 mm (12 in) max.
e) Edge radius	1,53 mm (0.060 in) min. for all edges

2.3 Conveyor systems — General requirements

2.3.1 The conveyor systems of two mated pieces of equipment shall be at the same level with respect to each other, consistent with the size and stiffness of the device, so that the load when being transferred from one piece of equipment to the other is never totally supported by a single line of rollers or balls in a cresting situation or two lines in a bridging situation.

2.3.2 An edge or lead roller shall be provided that has the maximum possible diameter commensurate with design in order to absorb the initial impact load caused by transferring devices.

2.3.3 Systems design shall provide that when a device is transferred between pieces of equipment, the maximum allowable span between roller centrelines shall be 254 mm (10 in). Each piece of equipment shall have its conveying surfaces within 76,2 mm (3 in) of the extreme projection of the bed in the direction of the device movement. Any remaining structural projection shall be ramped or sloped off at 45° min. with no sharp edges.

2.3.4 All walkways, beams, or other structures must be at least 9,5 mm (0.375 in) below the top of the conveying surface.

2.3.5 Conveying surfaces shall be capable of conveying distributed downward-force loads of 14,5 kN/m^2 [1] (300 lbf/ft^2), and of supporting distributed downward-force loads of 29,0 kN/m^2 (600 lbf/ft^2).

2.4 Stops and guides

2.4.1 All mobile equipment shall have means to restrain devices adequately in fore, aft, lateral and vertical directions, while in transit. (A device which escapes its restraint cause damage to personnel and equipment.)

a) Unless specifically exempted by the device configuration, guide rails and end stops shall extend at least 101,6 mm (4 in) above the conveying surface.

b) The maximum centre to centre distance for stops shall not exceed 1 270 mm (50 in). The minimum width shall be 50,8 mm (2 in).

c) Guides shall be smooth and as continuous as is practical. Generous lead-in flares shall be provided to guide devices into position and to minimize impact loads.

d) The lateral dimensional clearance between guides and devices to be handled shall be 12,7 mm (0.50 in) minimum, 16 mm (0.625 in) maximum. For example, where the device is 2 235,2 mm (88 in) wide the distance between the guides shall be 2 250 mm (88.50 in) minimum, 2 253 mm (88.625 in) maximum.

2.4.2 Where vertical restraint lips are provided, they shall extend not more than 25,4 mm (1 in) maximum, 22,2 mm (0.875 in) minimum horizontally over the conveying surface, and shall be compatible with 9 g type pallets (NAS 3610 Class 1).

Vertical restraint members shall measure at least 31,75 mm (1.25 in) from top of the conveying surface to the underside of the restraint member.

2.4.3 A means of absorbing energy, incorporating stops, shall be used where the anticipated impact velocity will be greater than 18,29 m/min (60 ft/min). The energy absorption means shall reduce the impact to the equivalent of a device loaded to one half its containing capacity striking the stops at 18,29 m/min (60 ft/min) and coming to rest within 3,2 mm (0.125 in) while itself not exceeding a deflection of 12,7 mm (0.50 in).

2.4.4 No part of parts of the handling equipment shall scratch or damage the unit load device.

2.4.5 Means, such as roll-off stops, shall be incorporated to preclude inadvertent movement of a device off a handling system.

3 Procedures and practices

3.1 Transporting loaded aircraft unit load device

3.1.1 Transport speeds shall be in accordance with the following table :

Table — Transport speeds, km/h (miles/h)

Tyre type / Suspension	Solid metal		Solid rubber		Zero pressure*		Pneumatic	
	km/h	mile/h	km/h	mile/h	km/h	mile/h	km/h	mile/h
Unsprung	8,05	5	12,87	8	24,14	15	32,19	20
Sprung	—	—	24,14	15	32,19	20	Road speeds	

* Cushion type solid rubber tyres of pneumatic configuration.

1) 1 N/m^2 = 1 Pa

3.1.2 When transporting loaded cargo containers, all doors shall be closed and latched.

3.1.3 When transporting empty cargo containers, doors shall be either closed and latched, or secured within the container.

3.1.4 When transporting non-structural igloos, loaded or empty, all net fittings at pallet and at net closing shall be secured.

3.1.5 When transporting pallet/net combinations, loaded or empty, the net shall be contained within the periphery of the pallet edge member.

3.1.6 Unless used with ancillary handling equipment meeting the requirements of this International Standard, or unless the device is designed for such handling, fork lifts may not be used to move devices.

3.1.7 Except for devices such as empty pallets and some 8 ft × 8 ft (2,44 m × 2,44 m) containers specifically designed for stacking, devices shall not be stacked.

3.1.8 Restraints as provided for in 2.4 shall be applied prior to movement.

3.1.9 If equipment utilizing multi-directional conveyor surfaces is used for the purpose of transporting devices, protection equivalent to 2.1.1 shall be provided.

NOTE — The metric units herein are exact converted equivalents except in the cases where equivalent manufacturing standards are established in metric units for the relevant component.